WHAT IS CLAIMED IS:

1. A method of producing a metal surface having a desired localized surface plasmon resonance (LSPR) wavelength, said method comprising the steps of:

depositing metal onto a substrate that does not have a mask prearranged thereon; and

controlling one or more deposition parameters of said depositing step to tailor the LSPR of said metal to a desired wavelength.

2. The method of claim 1 wherein said one or more deposition parameters include at least one of the parameters selected from the group consisting of:

temperature of said substrate during said depositing step, deposition rate, and amount of said metal deposited during said depositing step.

3. The method of claim 1 wherein said controlling step includes controlling each of the following deposition parameters:

temperature of said substrate during said depositing step, deposition rate, and amount of said metal deposited during said depositing step.

4. The method of claim 1 wherein said metal is selected from the group consisting of: silver, gold, and copper.

5. The method of claim 1 further comprising the step of:

utilizing a thermal evaporator to perform said depositing step.

6. The method of claim 1 further comprising the step of utilizing any of the following to perform said depositing step:

thermal evaporation, sputter deposition, electron-beam lithography, laser ablation, and chemical vapor deposition.

7. The method of claim 1 further comprising the step of:

determining said desired wavelength.

8. The method of claim 7 wherein said desired wavelength is a wavelength that provides maximum extinction of a particular excitation light source.

9. The method of claim 1 further comprising the step of:

determining at least one appropriate value for each of said one or more deposition parameters that result in said LSPR of said metal having said desired wavelength.

10. The method of claim 9 further comprising the step of:

utilizing a control algorithm to perform said determining step.

11. The method of claim 10 further comprising the step of:

deriving said control algorithm through analysis of a particular deposition process utilized to perform said depositing step.

12. A method of producing an enhancement surface for use in a surface-enhanced spectroscopy process, wherein said enhancement surface has a desired localized surface plasmon resonance (LSPR) wavelength, said method comprising the steps of:

determining the wavelength of an excitation light source used in said surface-enhanced spectroscopy process;

determining an appropriate value for one or more deposition parameters to use in depositing metal onto a substrate to produce an enhancement surface having a LSPR wavelength that provides optimum enhancement for said excitation light source; and

depositing metal onto a substrate in accordance with the determined value for one or more deposition parameters to produce an enhancement surface having said LSPR wavelength that provides optimum enhancement for said excitation light source, wherein said substrate does not have a mask prearranged thereon.

13. The method of claim 12 wherein said one or more deposition parameters include at least one of the parameters selected from the group consisting of:

temperature of said substrate during said depositing step, deposition rate, and amount of said metal deposited during said depositing step.

14. The method of claim 12 wherein said step of determining an appropriate value for one or more deposition parameters includes determining an appropriate value for each of the following deposition parameters:

temperature of said substrate during said depositing step, deposition rate, and amount of said metal deposited during said depositing step.

15. The method of claim 12 wherein said metal is selected from the group consisting of: silver, gold, and copper.

16. The method of claim 12 further comprising the step of:

utilizing a thermal evaporator to perform said depositing step.

17. The method of claim 12 further comprising the step of utilizing any of the following to perform said depositing step:

thermal evaporation, sputter deposition, electron-beam lithography, laser ablation, and chemical vapor deposition.

18. The method of claim 12 wherein said excitation light source is a laser.

19. The method of claim 12 wherein said LSPR wavelength that provides optimum enhancement comprises:

a wavelength that provides maximum extinction of said excitation light source.

20. The method of claim 12 wherein said step of determining an appropriate value for one or more deposition parameters further comprises the step of:

utilizing a control algorithm to perform said determining of said appropriate value for one or more deposition parameters.

21. The method of claim 20 further comprising the step of:

deriving said control algorithm through analysis of a particular deposition process utilized to perform said depositing step.

22. The method of claim 12 wherein said surface-enhanced spectroscopy process includes surface-enhanced Raman spectroscopy.

23. A system for producing a metal surface having a desired localized surface plasmon resonance (LSPR) wavelength, said system comprising:

a clean substrate;

computing means for determining an appropriate value for one or more deposition parameters to use in depositing metal onto said clean substrate to produce a metal surface having a LSPR of a desired wavelength; and

means for depositing said metal directly onto said clean substrate according to the determined value for one or more deposition parameters.

24. The system of claim 23 wherein said substrate comprises a smooth surface.

25. The system of claim 23 wherein said substrate comprises at least one of the group consisting of:

glass, metal, and dielectric surface.

26. The system of claim 23 wherein said means for depositing includes a thermal evaporator.

27. The system of claim 23 wherein said means for depositing includes means for performing any deposition selected from the group consisting of:

thermal evaporation, sputter deposition, electron-beam lithography, laser ablation, and chemical vapor deposition.

28. The system of claim 23 wherein said computing means comprises a processor-based device.

29. The system of claim 28 wherein said computing means is configured to execute a control algorithm for determining an appropriate value for said one or more deposition parameters.

30. The system of claim 29 wherein said control algorithm is embodied in software code executable on said processor-based device.

31. The system of claim 23 wherein said one or more deposition parameters include at least one of the parameters selected from the group consisting of:

temperature of said substrate during deposition of said metal thereon, deposition rate, and amount of said metal deposited onto said substrate.

32. The system of claim 23 wherein said computing means for determining an appropriate value for one or more deposition parameters comprises means for determining an appropriate value for each of the following deposition parameters:

temperature of said substrate during deposition of said metal thereon, deposition rate, and amount of said metal deposited onto said substrate.

33. The system of claim 23 wherein said metal is selected from the group consisting of: silver, gold, and copper.

34. The system of claim 23 further comprising:

means for determining said desired wavelength.

35. The system of claim 23 wherein said desired wavelength is a wavelength that provides maximum extinction of a particular excitation light source.

36. The system of claim 35 wherein said particular excitation light source includes a laser utilized in a surface-enhanced spectroscopy process.

37. A method of producing a metal film having a desired localized surface plasmon resonance (LSPR) wavelength, said method comprising the steps of:

determining appropriate values for deposition parameters to use in depositing metal onto a substrate to produce a metal film having a LSPR of a desired wavelength, wherein said deposition parameters include deposition rate, substrate temperature, and thickness of said metal film; and

depositing said metal onto said substrate in accordance with the determined deposition parameter values to produce a metal film having said LSPR of a desired wavelength.

38. The method of claim 37 wherein said metal is selected from the group consisting of: silver, gold, and copper.

39. The method of claim 37 further comprising the step of:

utilizing a thermal evaporator to perform said depositing step.

40. The method of claim 37 further comprising the step of utilizing any of the following to perform said depositing step:

thermal evaporation, sputter deposition, electron-beam lithography, laser ablation, and chemical vapor deposition.

41. The method of claim 37 further comprising the step of:

determining said desired wavelength of said LSPR.

42. The method of claim 41 wherein said desired wavelength is a wavelength that provides maximum extinction of a particular excitation light source.

43. The method of claim 42 wherein said particular excitation light source includes a laser utilized in a surface-enhanced spectroscopy process.

44. The method of claim 37 further comprising the step of:

utilizing a control algorithm to perform said determining step.

45. The method of claim 44 further comprising the step of:

deriving said control algorithm through analysis of a particular deposition process utilized to perform said depositing step.

46. The method of claim 37 wherein said substrate does not include a mask prearranged thereon before said depositing step.

47. The method of claim 37 wherein said substrate is a smooth substrate.

48. The method of claim 37 further comprising the step of:

cleaning said substrate before said depositing step, wherein no further pretreatment of said substrate is performed before said depositing step.

49. A method of deriving a control algorithm for controlling a deposition process in a manner that results in said deposition process producing a metal film that has a localized surface plasmon resonance (LSPR) of a desired wavelength, said method comprising:

utilizing a deposition process to deposit metal samples onto one or more substrates;

varying the value of at least one deposition parameter for each of said metal samples deposited;

analyzing said metal samples to determine the effect of said at least one deposition parameter on the LSPR wavelength of said metal samples; and

based on said analyzing step, determining said control algorithm that defines a resulting LSPR wavelength of a metal film produced by said deposition process as a function of said at least one deposition parameter.

50. The method of claim 49 wherein one or more appropriate values of said at least one deposition parameter that results in production of a metal film having a LSPR of a desired wavelength are determinable from said control algorithm.

51. The method of claim 50 wherein said desired wavelength is a wavelength that provides maximum extinction of a particular excitation light source.

52. The method of claim 49 wherein said at least one deposition parameter includes one or more of the parameters selected from the group consisting of:

temperature of a substrate on which a metal is deposited by said deposition process to produce said metal film, deposition rate of said metal by said deposition process, and amount of said metal deposited by said deposition process.

53. The method of claim 49 wherein said at least one deposition parameter includes at least the following deposition parameters:

temperature of a substrate on which a metal is deposited by said deposition process to produce said metal film, deposition rate of said metal by said deposition process, and amount of said metal deposited by said deposition process.

54. The method of claim 49 wherein said metal is selected from the group consisting of: silver, gold, and copper.

55. The method of claim 49 wherein said deposition process includes utilizing a thermal evaporator.

56. The method of claim 49 further comprising:

coding said control algorithm into software code executable by a processor-based device.

57. The method of claim 56 wherein said software code is executable by said processor-based device to determine one or more appropriate values of said at least one deposition parameter that results in production of a metal film having a LSPR of a desired wavelength.